69. The method of Claim 66, wherein a plurality of the sidewalls are on different sides of the piezoelectric element and are curved away from a longitudinal axis of the piezoelectric element.

REMARKS

A number of claims were deemed allowable if a Section 112 indefiniteness rejection on the meaning of "elastic limit" were overcome. The remaining claims were rejected on various references based on the Examiner's undefined understanding of "elastic limit." The term "elastic limit" is believed to be sufficiently definite to one of ordinary skill in the art who has read the specification, as explained and illustrated below. As none of the cited references disclose stressing sidewalls beyond their elastic limit, the Examiner is requested to reconsider and withdraw the rejection. New claims 46-69 are submitted herewith to more broadly define the invention.

Section 112 Rejection:

Claims 1-39 and 45 were rejected as indefinite under Section 112 because the "description of the sidewalls being 'stressed beyond their elastic limit' is somewhat confusing. Does this simply mean that the applied stress results in a plastic deformation, such that the curved shape cited in the later claims is achieved?" Office Action at 2.

A finding of indefiniteness "requires a determination of whether those skilled in the art would understand what is claimed when the claim is read in light of the specification." *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986).

The elastic limit is believed to be something known to a person skilled in the art. It is taught in basic classes on the strength of materials. Exemplary materials discussing the elastic limit are attached as Exhibit 1, taken from the 7th Edition of the Standard Handbook for Mechanical Engineers, by Baumeister & Marks. The Marks handbook says that "The elastic limit is the greatest stress which can be applied without leaving a permanent deformation upon complete release of the load. ... which differs little from the proportional elastic limit." Marks at 5-2. The specification also discusses the elastic limit at several locations, including page 35,

line 19 to page 35, line 15. The term "elastic limit" is thus believed to be sufficiently definite to comply with Section 112, second paragraph.

The Examiner asked a specific question: Does elastic limit simply mean that the applied stress results in a plastic deformation, such that the curved shape cited in the later claims is achieved? Office Action at 2. This question may be prompted in part by several of the references cited by the Examiner that illustrated how parts bend under the application of a specific load.

Claims 4-5 are illustrative dependent claims defining curved sidewalls. There is nothing literally stated in those claims to exclude a sidewall that is curved because a plastic deformation was used to form the curved shape. If curved metal shapes are made by plastic deformation, it is common to reheat the metals to relieve the residual stresses so that the curved members are essentially no longer stressed beyond their elastic limit. In addition, most claims, such as Claim 1, also define sidewalls that are stressed beyond their elastic limit "to hold the vibration element in compression." New claims are added to further broaden the protection for curved sidewalls.

As the claim term "elastic limit" is believed to be understood by one skilled in the art, reconsideration and withdrawal of the Section 112, paragraph 2 rejection is respectfully requested.

Claims 1 and 3 are also amended to resolve an inconsistent use of "vibration source" and "vibration element." This clarifying change does not narrow the scope of the claim.

Section 103 Rejections On Owen and Reuter

Claims 1-5, 11-20, 22-24 were rejected as obvious over Owen (5,109,698) in view of Reuter (5,900,691). Owen was said to have sidewalls 12 stressed beyond their elastic limit to hold the vibration element in compression, citing Col. 5, lines 21-24. Reuter was also said to disclose springs 56 stressed beyond their elastic limit. The Applicants respectfully maintains that the cited patents do not support those characterizations, and thus even the proffered combination of Owen and Reuter does not meet the claim requirements as is essential for a rejection under Section 103.

In rejecting claims under 35 U.S.C. § 103, the Patent Office bears the initial burden of presenting a *prima facie* case of obviousness. *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir.

1992). To establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest **all** the claim limitations. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438, 20 USPQ2d 1438 (Fed. Cir. 1991), MP.E.P. § 2143. This burden has not been met here.

The Examiner did say that the references disclosed members stressed beyond the elastic limit "as that term is understood." The Examiner also issued a Section 112 indefiniteness regarding the meaning of elastic limit. Despite this expressed confusion, the Applicants maintain that the elastic limit is used in the specification and claims in a manner consistent with the long recognized meaning accorded to "elastic limit," as discussed above. As the Examiner did not explain any specific meaning of elastic limit that was being used in rejecting the claims, the Applicants cannot comment on the Examiner's understanding – other than to say the cited references do not meet the claim requirement regarding elastic limit. If this rejection is maintained, please explain what understanding or meaning is used when construing the term "elastic limit" so that the Applicants can respond.

Owen's '698 Patent Does Not Disclose Stressing Walls Beyond The Elastic Limit:

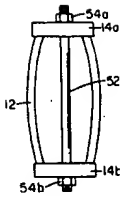
Exceeding the elastic limit causes a permanent deformation with the amount of that deformation for a given load varying with each material. Such permanent deformation is usually highly undesirable, and is something that is usually avoided. Stressing a part beyond its elastic limit is typically the first step toward breaking a part. It is not desirable to break parts, and this is recognized in the Flanagan patent. Flanagan says that one "problem" with applying excessive force and the resulting excessive stress, is that it "can cause the shell to yield, resulting in a ruptured shell." Flanagan, Col. 2, lines 33-34. Flanagan also applied the standard practice by designing parts so they prestress the piezoelectric element, but do not yield or plastically deform: "As is known in the art ... When the compressed force on the elliptical shell is removed, the shell returns to its uncompressed shape ...." Col. 3, lines 66 to Col. 4, line 14.

But Claim 1 and others also define placing the piezoelectric element in compression, and that is believed to inherently require that while the sidewalls are stressed beyond their elastic

limit, they are not stressed beyond their ultimate limit so that the walls rupture and loose the ability to place the piezoelectric element in compression as defined in the claim.

Nowhere in the text of Owen's '698 patent is there any mention that the walls are stressed beyond the elastic limit. Nowhere is there any indication that Owen departed from the normal practice of not exceeding the elastic limit. Until such text is identified, there is not even a *prima facie* basis for establishing that the material is stressed beyond its elastic limit, and a *prima* facie basis for the rejection has not even been established. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991), M.P.E.P. § 2143.

Owen uses a cylindrical tube that is prestressed by a bolt or rod to cause the walls of the tube to bow, as shown here, and as described in the patent as follows:



> "In FIG. 5, shell 12 has been pre-stressed to have an outward curvature. This pre-stress may be the result of a static compressional, force that causes a static outward deflection of the shell 12." Col. 5, lines 21-41.

Merely pre-stressing a part does not mean it is stressed beyond its elastic limit. Indeed, the specification explains that piezoelectric elements are preloaded, or prestressed, by applying a compressive force. App. at 21, line 34 to page 22, line 2. The specification even discusses using a threaded screw to compress the piezoelectric element. App. at 22, lines 5-20. Owen does what is described in the specification by compressing the piezoelectric element, using a threaded bolt to clamp opposing ends of the tubular shell 12. That it bows the walls of the tubular shell 12 outward does not mean the walls are stressed beyond their elastic limit, and nowhere in Owen is that stated or suggested.

Moreover, Owen describes the walls as being a thin shell, 12. In fact, the thickness of the wall of shell 12 is required to be small compared to the radius, and the length is large compared to width of the shell. Col. 5, lines 19-23. That describes a long, thin-walled tube. Long, thin walled tubes will usually buckle and collapse before the thin walls are stressed beyond the yield limit. But if the walls of the thin shell 12 buckle, they cannot oscillate as required for Owen's invention. That teaches against any attempt to imply that the thin walls of shell 12 are stressed beyond their elastic limit.

As the Owen patent does not disclose stressing the walls beyond their elastic limit, there is no *prima facie* basis for the rejection. The Examiner is requested to reconsider and withdraw his rejection.

The Reuter '691 Patent Does Not Disclose Stressing Walls Beyond The Elastic Limit:

Reuter's side springs 56 were said to be stressed beyond their elastic limits. The Reuter patent refers to spring means that "include deflectable spring members 55 which perform the function of the solid state joints 6 and the pretensioning members 5 ...." Col. 4, lines 10-14. The joints 6 and pretensioning member 5 merely provide a pre-tensioning force on the "order of size of 20 to 25 N/mm^2." Col. 3, lines 21-30.

The above-identified portions do not once mention elastic limit, nor do they mention stressing the springs beyond any elastic limit. To the contrary, there are believed to be no other description of the springs in the Reuter patent, and no references in the Reuter patent to stressing the springs beyond their elastic limit. Unless and until the claimed limitations are provided in a reference a *prima facie* basis for the rejection has not even been established. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991), M.P.E.P. § 2143.

The Examiner is requested to reconsider, and withdraw the rejection based on Reuter.

Reuter & Owen Are Not Properly Combined

As noted above, even if combined the Owen and Reuter patents do not disclose the defined sidewalls stressed beyond their elastic limit. But in order to even combine these two references, there must first be some suggestion or motivation, either in prior art references or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Second, there must be a reasonable expectation of success. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in Applicant's disclosure. *In re Vaeck,* 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991), M.P.E.P. § 2143.

The Examiner says it is obvious to add to Reuter the bowed walls of Owen "in order to add strength to the device, as such is noted as being a defect, which Reuter calls 'poor rigidity' in the prior art as cited by Reuter at col. 2, ll. 10-15." Office Action at 5.

Where is the teaching that Owen even provides the sufficiently stiff or rigid spring that the Examiner hypothesizes is needed? This is especially apt when Owen describes a long, thin walled shell 12 and thus likely lacks high stiffness and rigidity that Reuter allegedly said is needed. Owen at Col. 4, lines 19-23. Where is the teaching to select the Owen thin wall shell 12 out of the myriad of potential references? Why use Owen's thin walled shell which is designed to axially oscillate and instead use it as a stiff or rigid spring in an application that requires two piezoelectric stacks to be as close together as possible? And most importantly, where is the basis **in the record** for the proffered motivation that Owen fulfills the proffered need? Where is the basis in the record for ignoring the above listed questions, the answers to which are believed to negate the proffered modification and combination and negate any expectation of success?

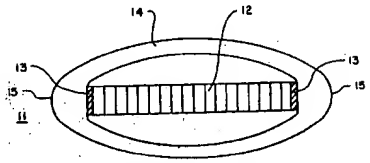
> The Examiner must not only explain the motivation for modifying or combining references, but must point to some concrete evidence in the record supporting the motivation to modify or combine. As an administrative tribunal, the Board clearly has expertise in the subject matter over which it exercises jurisdiction. This expertise may provide sufficient support for conclusions as to peripheral issues. With respect to core factual findings in a determination of patentability, however, **the Board cannot simply reach conclusions based on its own understanding or experience - or on its assessment of what would be basic knowledge or common sense. Rather, the Board must point to some concrete evidence in the record in support of these findings.** To hold otherwise would render the process of appellate review for substantial evidence on the record a meaningless exercise. [*In re Zurko*, 59 USPQ2d 1693, 1697 (Fed. Cir. 2001) (emphasis added)].

Here, there is no concrete evidence in the record on which to base the proffered modifications of both Reuter and Owen, and to combine those two references. The above identified questions illustrate why the references teach against the proffered modifications and combination and why there is no reasonable expectation of success. There is no reasonable expectation that the thin wall shall 12 of Owen will serve as the "stiff" spring 56 which is the proffered reason for taking isolated aspects of the references and combining them.

The Examiner is urged to avoid the insidious temptation of hindsight in using the specification to pick and choose isolated aspects from the prior art and then devising reasons for combining those isolated features. The Examiner is requested to reconsider, and withdraw the rejection based on Owen and Reuter.

Section 102 Rejections On Marshall

Claims 25, 28, 20, 32 and 34 were rejected as anticipated by Marshall. Marshall is said to stress the sidewalls beyond the elastic limit "as that term is best understood." Office Action at 6. Marshall describes placing an oval transducer 11, as shown here, in a press and applying force to walls 14 to cause the distance between ends 15 to increase and allow insertion of piezoelectric stack 12.



Nowhere in Marshall is there a reference to stressing the walls 14 to any definable stress, let alone to stressing them beyond the elastic limit.

As the Marshall patent does not disclose stressing the walls beyond their elastic limit, there is no *prima facie* basis for the rejection. The Examiner is thus respectfully requested to reconsider and withdraw his rejection. If the Examiner disagrees and maintains the rejection, the Examiner is requested to state the "understanding" of the "elastic limit" term as applied by the Examiner and to identify the text in the Marshall patent meeting that definition.

Section 103 Rejection Of Claim 27 On Marshall

Dependent Claim 27 was rejected as obvious over Marshall. Claim 27 depends from Claim 25 and is thus allowable for the same reasons as is Claim 25. The Examiner is thus respectfully requested to reconsider and withdraw his rejection of Claim 27.

Section 103 Rejection Of Claim 31 On Marshall & Owen

Dependent Claim 31 was rejected as obvious over Marshall in view of Owen. Claim 31 depends from Claim 25 and is thus allowable for the same reasons as is Claim 25. The Examiner is thus respectfully requested to reconsider and withdraw his rejection of Claim 31.

Section 102 Rejection Of Claims 40-46 On Marshall & Flanagan

Various ones of Claims 40-46 were rejected as anticipated by Marshall or Flanagan.

Independent Claim 40 is amended to further define the features of Claim 45, including a piezoelectric element that stresses the sidewalls beyond the elastic limit. That is believed allowable for the reasons discussed above.

The "Press-Fit" Language

The Examiner stated that during examination the "press-fit" would not be given weight. Office Action at 5. Several of the claims are broadened by deleting the reference to press-fit.

New Claims

New Claims 46-69 are added to expressly cover sidewalls that are curved before the insertion of a piezoelectric element between the sidewalls. Antecedent basis is found in part at page 38, line 25 to page 40, line 19, which describes sidewalls that are curved before and after the piezoelectric element is inserted, and that is preferably used with the sidewalls stressed beyond their elastic limit.

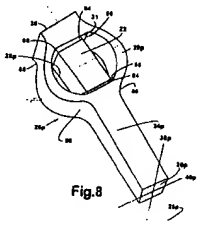


Fig.8

Ways to preload the sidewalls are discussed at several places, including page 83, line 22 to page 85, line 24. These ways include stressing the sidewalls beyond the elastic limit before inserting the piezoelectric, and stressing the walls beyond the elastic limit by inserting the piezoelectric (e.g., page 14, line 16).

New Claims 54 and 64-66 are added that define when the walls are stressed beyond the elastic limit.

New Claims 51, 52, and 57-59 are added to seek additional protection on various resonator configurations that have a constant cross-sectional area along defined lengths of the resonator. Antecedent basis is found in part in Figures 6, 8 and 77.

New Claims 56, 61-63 and 68 refer to the sidewalls stressed beyond their yield point but below their ultimate limit. Antecedent basis is found in part, at page 6, line 30 ("stressed beyond their yield point"), page 13, lines 34-35 (stressed beyond yield point but not beyond ultimate limit); pg. 36, lines 1-21 (advantages of this stress).

As noted in the Marks handbook, the yield strength is understood by one skilled in the art as a line parallel to but offset from the elastic stress-strain line by a predetermined distance, and "the permanent strain commonly used is 0.20 percent of the original gage length. The intersection of this line with the curve determines the stress value called the yield strength." Marks, at 5-2 to 5-3. Table 1 of Marks gives the yield strength for a variety of metals, including steel and aluminum which are commonly used resonator materials. A number of other references are available and were available at the time of filing that provide the elastic limit on most, if not all, commercially available materials. It is common for manufacturers of metals and other materials to provide such information as the modulus of elasticity, yield strength, ultimate strength, and other parameters so that engineers can use their specific materials in their calculations and ensure their materials fulfill the engineering strength requirements of the designs.

These claims are believed allowable and such allowance is respectfully requested.

New Figures 67-69

Figures 67 and 69 are submitted primarily to show specially shaped ends on the piezoelectric elements that make it easier to press-fit the piezoelectric elements into openings in the resonator. Figures 67 and 69 show an electrical connection that has an incorrect connection among adjacent piezoelectric elements. These figures are not needed for antecedent basis on the correct interconnection of piezoelectric elements, as that connection is well known to one skilled in the art, and the erroneously depicted connection of Figures 67 and 69 are believed to be apparent to one skilled in the art. Revised Figures 67 and 69 are submitted herewith showing the correct electrical interconnection. No new matter is added. Because Figure 68 appears on the same sheet, it is included, but is not changed.

CONCLUSION

The claims are believed to be in a condition for allowance and such allowance is respectfully requested. If the Examiner has any questions, please contact the undersigned in order to resolve any matters over the phone and to pass the application to issuance.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version With Markings to Show Changes Made."

If any additional fee is required, please charge Deposit Account Number 19-4330.

Respectfully submitted,

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